UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/684,662	10/14/2003	Douglas R. Armstrong	20002/15251	3392

34431 7590 02/08/2007
HANLEY, FLIGHT & ZIMMERMAN, LLC
150 S. WACKER DRIVE
SUITE 2100
CHICAGO, IL 60606

EXAMINER	
WANG, BEN C	
ART UNIT	**PAPER NUMBER**
2192	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/08/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/684,662	ARMSTRONG ET AL.	
	Examiner	Art Unit	
	Ben C. Wang	2192	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-41* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *08/11/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-41 are pending in this application and presented for examination

Claim Rejections – 35 USC § 102(b)

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102(b) that form the basis for the rejections under this section made in this office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by J. K. Hollingsworth (*An Online Computation of Critical Path Profiling, 1996 ACM, pp. 11-20*) (hereinafter 'Hollingsworth')

4. **As to claim 1**, Hollingsworth discloses a method of profiling a threaded program during program runtime (Abstract, Lines 1-5), the method comprising: monitoring information exchanged between a processing unit and first and second threads executed by the processing unit (Sec. 1, 1st Para., Lines 1-7; Sec. 1, 3rd Para., Lines 8-10; Sec. 2.3, 4th Para., 7th Para.; Fig. 4; Appendix A); determining, based on the information exchanged between the processing unit and the first and second threads, a critical path of thread execution (Sec. 1, 1st Para., 3rd Para., Lines 1-10; Fig. 2; Sec. 2.2, 1st Para.) and maintaining the critical path of thread execution in a critical path tree (Fig. 1; Sec. 2, 1st Para., Lines 1-5; Sec. 2.1, 1st Para., subsections of Process, Event, Program Execution, Program (Execution) Trace, CPU Time, Program Activity Graph

(PAG), 2nd Para., Lines 1-6); determining, based on the information exchanged between the processing unit and the first and second threads, a wait time during which the first thread awaits a synchronization event (Fig. 1 – two waiting events, one with shorter time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.); and determining whether the wait time affects the critical path of thread execution (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9; Footnote1 – p. 12; Fig. 1 – two waiting events, one with shorted time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.).

5. **As to claim 11**, Hollingsworth discloses an article of manufacture (Abstract, Lines 1-5) comprising a machine-accessible medium having a plurality of machine-accessible instructions that, when executed, causes a machine to: monitor information exchanged between a processing unit and first and second threads executed by the processing unit (Sec. 1, 1st Para., Lines 1-7; Sec. 1, 3rd Para., Lines 8-10; Sec. 2.3, 4th Para., 7th Para.; Fig. 4; Appendix A); determine, based on the information exchanged between the processing unit and the first and second threads, a critical path of thread execution (Sec. 1, 1st Para., 3rd Para., Lines 1-10; Fig. 2; Sec. 2.2, 1st Para.) and maintaining the critical path of thread execution in a critical path tree (Fig. 1; Sec. 2, 1st Para., Lines 1-5; Sec. 2.1, 1st Para., subsections of Process, Event, Program Execution, Program (Execution) Trace, CPU Time, Program Activity Graph (PAG), 2nd Para., Lines 1-6); determine, based on the information exchanged between the processing unit and the first and second threads, a wait time during which the first thread awaits a

synchronization event (Fig. 1 – two waiting events, one with shorter time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.); and determine whether the wait time affects the critical path of thread execution (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9; Footnote1 – p. 12; Fig. 1 – two waiting events, one with shorted time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.).

6. **As to claims 2 and 12**, Hollingsworth discloses indicating that the wait time is of a high priority if the wait time affects the critical path of thread execution and indicating that the wait time is of a low priority if the wait time does not affect the critical path of thread execution (Fig. 1 – two waiting events, one with shorter time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.).

7. **As to claims 3 and 13**, Hollingsworth discloses a leaf is added to the critical path tree when the synchronization event is a fork event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At split nodes (nodes with one inbound arc and two outbound arcs), the message is duplicated and sent on each of the outbound arcs; Footnote1 – p. 12 – to include other synchronization or communication events such as locks and barriers).

8. **As to claims 4 and 14**, Hollingsworth discloses a leaf is added to the critical path tree when the synchronization event is a signal event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At split nodes (nodes with one inbound arc

and two outbound arcs), the message is duplicated and sent on each of the outbound arcs; Footnote1 – p. 12– to include other synchronization or communication events such as locks and barriers).

9. **As to claims 5 and 15**, Hollingsworth discloses a leaf is removed from the critical path tree when the synchronization event is a wait event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At merge nodes, those with two inbound arcs and one outbound arc, only the longest path is propagated; Footnote1 – p. 12 – to include other synchronization or communication events such as locks and barriers).

10. **As to claims 6 and 16**, Hollingsworth discloses a leaf is added to the critical path tree when the synchronization event is an entry event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At split nodes (nodes with one inbound arc and two outbound arcs), the message is duplicated and sent on each of the outbound arcs; Footnote1 – p. 12– to include other synchronization or communication events such as locks and barriers).

11. **As to claims 7 and 17**, Hollingsworth discloses a leaf is removed from the critical path tree when the synchronization event is a block event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At merge nodes, those with two inbound arcs and one outbound arc, only the longest path is propagated; Footnote1 – p. 12 – to include other synchronization or communication events such as locks and barriers).

12. **As to claims 8 and 18**, Hollingsworth discloses a leaf is removed from the critical path tree when the synchronization event is a suspend event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At merge nodes, those with two inbound arcs and one outbound arc, only the longest path is propagated; Footnote1 – p. 12 – to include other synchronization or communication events such as locks and barriers).

13. **As to claims 9 and 19**, Hollingsworth discloses a leaf is added to the critical path tree when the synchronization event is a resume event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At split nodes (nodes with one inbound arc and two outbound arcs), the message is duplicated and sent on each of the outbound arcs; Footnote1 – p. 12– to include other synchronization or communication events such as locks and barriers).

14. **As to claims 10 and 20**, Hollingsworth discloses comparing a number of active threads to a number of processing resources to determine a utilization factor (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At merge nodes, those with two inbound arcs and one outbound arc, only the longest path is propagated; Footnote1 – p. 12 – to include other synchronization or communication events such as locks and barriers).

Claim Rejections – 35 USC § 103(a)

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made

16. Claims 21-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hollingsworth in view of Sarma et al. (Pat. No. US 6,988,264 B2) (hereinafter 'Sarma').

17. **As to claim 21**, Hollingsworth discloses a method of profiling a threaded program during program runtime (Abstract, Lines 1-5), the method comprising: monitoring information exchanged between a processing unit and first and second threads executed by the processing unit (Sec. 1, 1st Para., Lines 1-7; Sec. 1, 3rd Para., Lines 8-10; Sec. 2.3, 4th Para., 7th Para.; Fig. 4; Appendix A); determining, based on the cross-thread event, a critical path of thread execution (Sec. 1, 1st Para., 3rd Para., Lines 1-10; Fig. 2; Sec. 2.2, 1st Para.) and maintaining the critical path of thread execution in a critical path tree (Fig. 1; Sec. 2, 1st Para., Lines 1-5; Sec. 2.1, subsections of Process, Event, Program Execution, Program (Execution) Trace, CPU Time, Program Activity Graph (PAG), 2nd Para., Lines 1-6); determining, based on the cross-thread event and the information exchanged between the processing unit and the first and second threads (Sec. 2.3, 9th Para. through 11th Para.), a wait time during which the first thread awaits a synchronization event (Sec. 2.1, subsection of Event, Lines 8-9; Footnote1 – p. 12; Fig. 1 – two waiting events, one with shorted time and the other with longer time,

denoted in dotted-lines; Sec. 2.1, 3rd Para.); and determining whether the wait time affects the critical path of thread execution (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9; Footnote1 – p. 12; Fig. 1 – two waiting events, one with shorted time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.).

But Hollingsworth does not specifically disclose determinating when a cross-thread event has occurred.

However, in an analogous art of debugging multiple threads or processes, Sarma discloses determinating when a cross-thread event has occurred (Col. 10, Lines 1-8; Col. 3, Line 67 through Col. 4, Line 4; Fig. 19, element 25 – wait; Col. 1, Lines 39-41; Col. 7, item 9; Col. 7, item 10; Col. 11, item 25).

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Hollingsworth and the teachings of Sarma to further provide determinating when a cross-thread event has occurred in Hollingsworth system.

The motivation is to have a single instance of a debugger application that can be used in a multiple task/thread execution as once suggested by Sarma in the section of Summary of the Invention (Col. 2, Lines 28-33).

18. **As to claim 32**, Hollingsworth discloses an article of manufacture (Abstract, Lines 1-5) comprising a machine-accessible medium having a plurality of machine-accessible instructions, when executed, causes a machine to: monitor information exchanged between a processing unit and first and second threads executed by the

processing unit (Sec. 1, 1st Para., Lines 1-7; Sec. 1, 3rd Para., Lines 8-10; Sec. 2.3, 4th Para., 7th Para.; Fig. 4; Appendix A); determine, based on the cross-thread event, a critical path of thread execution (Sec. 1, 1st Para., 3rd Para., Lines 1-10; Fig. 2; Sec. 2.2, 1st Para.) and maintaining the critical path of thread execution in a critical path tree (Fig. 1; Sec. 2, 1st Para., Lines 1-5; Sec. 2.1, subsections of Process, Event, Program Execution, Program (Execution) Trace, CPU Time, Program Activity Graph (PAG), 2nd Para., Lines 1-6); determine, based on the cross-thread event and the information exchanged between the processing unit and the first and second threads (Sec. 2.3, 9th Para. through 11th Para.), a wait time during which the first thread awaits a synchronization event (Fig. 1 – two waiting events, one with shorter time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.); and determine whether the wait time affects the critical path of thread execution (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9; Footnote1 – p. 12; Fig. 1 – two waiting events, one with shorted time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.).

But Hollingsworth does not specifically disclose determinating when a cross-thread event has occurred.

However, in an analogous art of debugging multiple threads or processes, Sarma discloses determinating when a cross-thread event has occurred (Col. 10, Lines 1-8; Col. 3, Line 67 through Col. 4, Line 4; Fig. 19, element 25 – wait; Col. 1, Lines 39-41; Col. 7, item 9; Col. 7, item 10; Col. 11, item 25).

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Hollingsworth and the

teachings of Sarma to further provide determinating when a cross-thread event has occurred in Hollingsworth system.

The motivation is to have a single instance of a debugger application that can be used in a multiple task/thread execution as once suggested by Sarma in the section of Summary of the Invention (Col. 2, Lines 28-33).

19. **As to claims 22 and 33**, Hollingsworth discloses indicating that the wait time is of a high priority if the wait time affects the critical path of thread execution and indicating that the wait time is of a low priority if the wait time does not affect the critical path of thread execution (Sec. 2.1, subsection of Event, Lines 8-9; Footnote1 – p. 12; Fig. 1 – two waiting events, one with shorted time and the other with longer time, denoted in dotted-lines; Sec. 2.1, 3rd Para.).

20. **As to claim 23**, Hollingsworth does not disclose a method wherein the cross-thread event is selected from a group consisting of a fork event, an entry event, a signal event, a wait event, a suspend event, a resume event, and a block event.

However, in an analogous art of debugging multiple threads or processes, Sarma discloses a method wherein the cross-thread event is selected from a group consisting of a fork event, an entry event, a signal event, a wait event, a suspend event, a resume event, and a block event.

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Hollingsworth and the

teachings of Sarma to further provide a method wherein the cross-thread event is selected from a group consisting of a fork event, an entry event, a signal event, a wait event, a suspend event, a resume event, and a block event in Hollingsworth system.

The motivation is to have a single instance of a debugger application that can be used in a multiple task/thread execution as once suggested by Sarma in the section of Summary of the Invention (Col. 2, Lines 28-33).

21. **As to claims 24 and 34**, Hollingsworth discloses a leaf is added to the critical path tree when the synchronization event is a fork event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At split nodes (nodes with one inbound arc and two outbound arcs), the message is duplicated and sent on each of the outbound arcs; Footnote1 – p. 12– to include other synchronization or communication events such as locks and barriers).

22. **As to claims 25 and 35**, Hollingsworth discloses a leaf is added to the critical path tree when the synchronization event is a signal event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At split nodes (nodes with one inbound arc and two outbound arcs), the message is duplicated and sent on each of the outbound arcs; Footnote1 – p. 12– to include other synchronization or communication events such as locks and barriers).

23. **As to claims 26 and 36**, Hollingsworth discloses a leaf is removed from the critical path tree when the synchronization event is a wait event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At merge nodes, those with two inbound arcs and one outbound arc, only the longest path is propagated; Footnote1 – p. 12 – to include other synchronization or communication events such as locks and barriers).

24. **As to claims 27 and 37**, Hollingsworth discloses a leaf is added to the critical path tree when the synchronization event is an entry event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At split nodes (nodes with one inbound arc and two outbound arcs), the message is duplicated and sent on each of the outbound arcs; Footnote1 – p. 12– to include other synchronization or communication events such as locks and barriers).

25. **As to claims 28 and 38**, Hollingsworth discloses a leaf is removed from the critical path tree when the synchronization event is a block event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At merge nodes, those with two inbound arcs and one outbound arc, only the longest path is propagated; Footnote1 – p. 12 – to include other synchronization or communication events such as locks and barriers).

26. **As to claims 29 and 39**, Hollingsworth discloses a leaf is removed from the critical path tree when the synchronization event is a suspend event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At merge nodes, those with two inbound arcs

and one outbound arc, only the longest path is propagated; Footnote1 – p. 12 – to include other synchronization or communication events such as locks and barriers).

27. **As to claims 30 and 40**, Hollingsworth discloses a leaf is added to the critical path tree when the synchronization event is a resume event (Sec. 2.1, 1st Para., subsection of Event, Lines 8-9, 3rd Para. – At split nodes (nodes with one inbound arc and two outbound arcs), the message is duplicated and sent on each of the outbound arcs; Footnote1 – p. 12– to include other synchronization or communication events such as locks and barriers).

28. **As to claims 31 and 41**, Hollingsworth discloses comparing a number of active threads to a number of processing resources to determine a utilization factor (Sec. 1, 1st Para., Lines 1-7; Sec. 1, 3rd Para., Lines 8-10; Sec. 2.3, 4th Para., 7th Para.; Fig. 4; Appendix A).

Conclusion

29. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Berry et al., *Processing Events During Profiling of an Instrumented Program* (Pat. No. US 6,728,955 B1).

30. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben C. Wang whose telephone number is 571-270-1240. The examiner can normally be reached on Monday - Friday, 8:00 a.m. - 5:00 p.m., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on 571-272-3695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

BCW BW

TUAN DAM
SUPERVISORY PATENT EXAMINER

January 30, 2007